## Successes and Challenges of Computer Security Research

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## What do we mean when we say "security"?





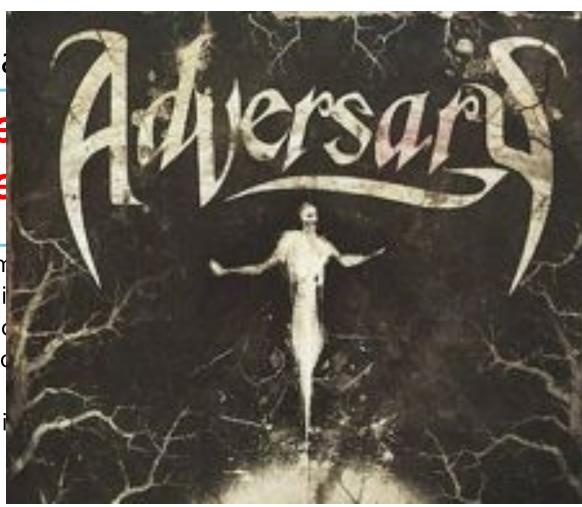


## What do we mean when we say "security"?

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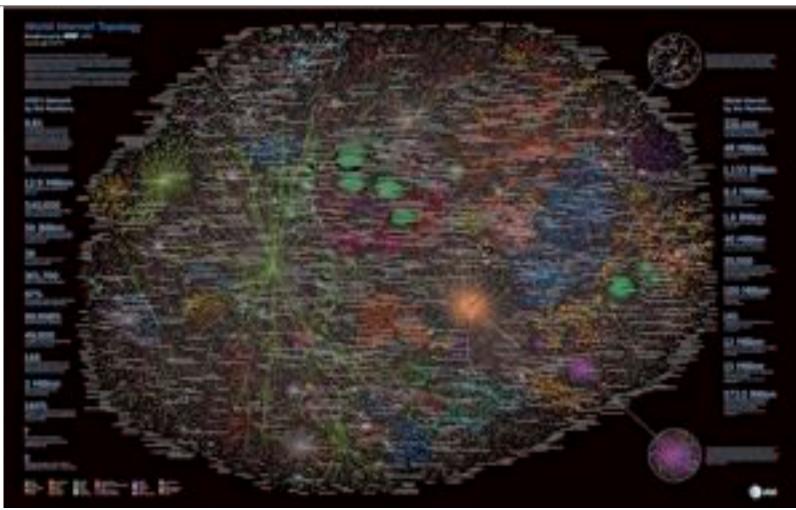


# Technological change = new dangers and new fears





### The big change: global connectivity





## **Managing risk**





### Example: e-commerce

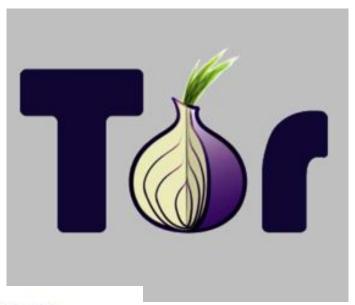
#### What made this possible?

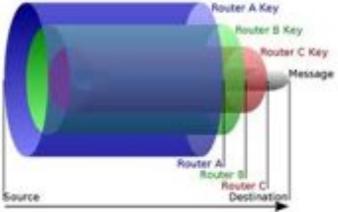
- Public-key cryptography
- Efficient private-key cryptography
- Key-exchange protocols
- Certificate authorities and trust hierarchies



## Example: anti-censorship









## NITRD efforts underlie most of today's defensive technologies

- Virtual private networks
- Network defenses
  - Firewalls, intrusion detection, data leakage protection
- Two-factor authentication
- Anti-malware
- Exploit mitigation (ASLR, DEP, stack cookies)
- Vulnerability finding tools, safe languages
- Virtual machine isolation

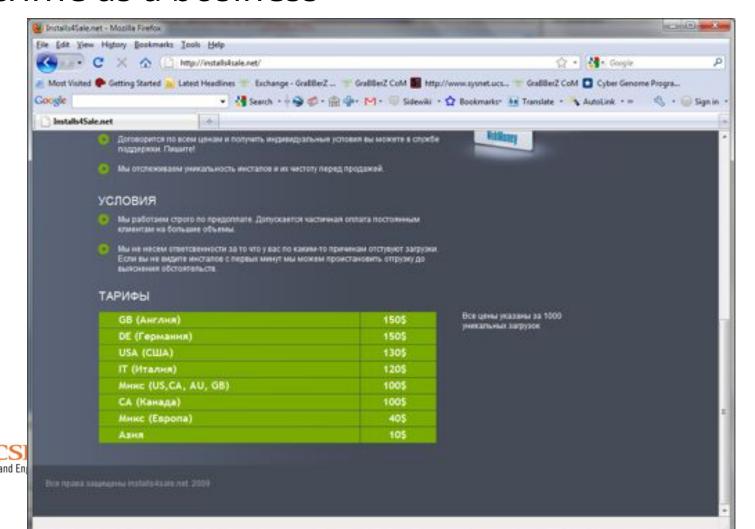


### Challenge: structural asymmetries

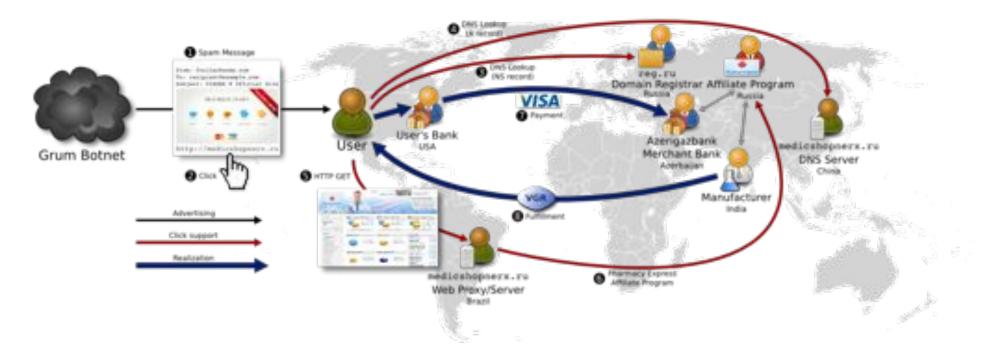
- Initiative: Defenders reactive, attackers proactive
  - Defenses public, attacker develops/tests in private
  - Arms race where best case for defender is to "catch up"
- Innovation: New defenses expensive, new attacks cheap
  - Defenses sunk costs/business model
  - Attacker agile and not tied to particular technology
- Incentives: Low risk to attack, low reward to defend
  - Minimal deter ence; functional anonymity on Internet
  - Security is rarely a key competitive feature (why? see next)
- Evaluation: Defenses hard to measure, attacks easy
  - Few security metrics (no "evidence-based" security)
  - Attackers measure success/monetization which drives attack quality



E-crime as a business



E-crime as a business





Mass action/hacktivism





State-motivated/sponsored actors





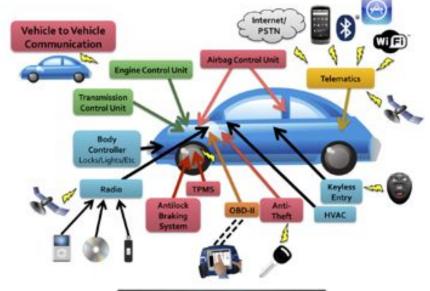


### Challenges: the Internet of things



## Computer security meets the real world









## The value of security research

- Security is a game of innovation
- Keeping up, staying ahead; readiness



...down the road, the cyberthreat, which cuts across all [FBI] programs, will be the number one threat to the country."

-- Robert Mueller, Jan 31, 2012



## Thank you

• Questions?

